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Unaxis Wafer Processing's first LLS was built in 1979. Since then, over 240 LLS systems have been installed, with more than 100 being LLS EVOs. Credited with flexibility regarding target materials, substrate size, film uniformity, reproducibility, co-sputter-

ing, simple operation and easy maintenance, the LLS found its markets. Development of the EVO II, as in all new generations of manufacturing machinery, has resulted from important user input and observations from thoughtful service engineers.

Unaxis LLS evolves into the EVO II

Over the past five years, information has been collected from customers and application/service engineers for the potential to improve the existing LLS EVO. Proven modules, vacuum chamber, sputter sources, degas, RF etch and ionmilling have not been changed to maintain process compatibility. But the water supply, gas, front panel, rack cabinet, graphic user interface, control unit, segment sputtering, service hoist, and media consumption display have been added or adapted.

Media supply

Service and maintenance of the water battery has been simplified. The completely reworked water battery is one of the three main modules. Start-up time at customer sites has reduced, due to the fact that all interfaces between rack cabinet, water battery and vacuum chamber are now equipped with fast plug connectors.

Pneumatic valves and flow-meter are controlled via Profibus, screw couplings are stainless steel. Steering and power cables are separated in defined position. The decentralised periphery means less cables.

Water pressures are controlled with a manometer and all water pipes equipped with plug

connectors. Each cathode has a separate water supply with flow-meter indicating actual values. Waterpipe diameter has changed from 3/4" to 1.5". 'Blow out' of the water supply (pipes and cathodes) during target exchange is standard, and very user-friendly.

By changing analog control to digital Profibus, interference of the Mass Flow Controllers is ended. The new digital MFC allows a reduction in the variety of MFCs to two sizes (50sccm and 200sccm) calibrated for all process gases (Ar, N₂, O₂ and H₂) used in the equipment.

The front panel width is reduced by more than 15% from 2.5m to 2.1m. User functionality is optimised and simplified. A new keyboard includes trackball and integrated flat panel display.

Rack cabinet

The optimised rack cabinet also contributes to over 10% reduction in floor space. Rack modules (RF generator, power supplies, PCs) are now located left of the control rack. Power rack space included for the optional auto handler control and power units, is located to the right. Both power rack doors are front openers, so the only space required behind the control and power racks is for media supply. Also new is the flat panel display integration into the front panel of the control rack and its stow-away keyboard.

Control unit process optimisation and reduction of floor space were main reasons for change of the control unit. The old Simatic S7 PLC is supplanted by the latest Soft PLC, which runs on a PC rack module. Two independent computers are used for Soft GUI, completely re-designed with a Windows XP OS, making recipe view-and-run protocol more user-friendly. A SECS/ GEM interface is available as an option. Both rack module computers are at the top of the control rack. In addition to dynamic sputtering, the new rotary

The sleek frontage of the Unaxis LLS EVO II



drive enables specific segment sputtering, useful for laboratories with expensive target materials as well as for dynamic sputtering.

A new service hoist simplifies service and maintenance. It is integrated into the LLS EVO II as standard. In addition to the substrate cage and rotation engine, the design now also allows removal of the LC pump and high vacuum valve.

Media consumption displays power, water, Ar, N₂, O₂, H₂, vent nitrogen and compressed air consumption. These are now recorded, available as current, monthly and annual printouts, conforming to ISO 14001.

Miscellaneous

The three main modules - water battery, rack cabinet and process chamber on the platform with fixed front panel - result in reduced customer installation time, and simplify logistics.

Integrated, improved documentation from DocuCat, an add-on module for SPCat, links all fields of service documentation (operating, OEM instructions, spare parts catalogue) into one database, integrating them in a control interface.

Due to the reduction in width and the new optimised rack cabinet, a total footprint reduction of about 20% has been achieved.

The modified anode frame protects the anode flange from being coated. The inside of the load chamber is now fully shielded. The shutter box in the main chamber is modified to grant a better gas flow distribution and pump characteristic enabling better film uniformities, especially in reactive sputtering.

Regardless of the position of the various cathodes, they perform more uniformly when compared against each other - another advantage to the LLS EVO II.

All these benefits add up to quicker assembly and installation, shorter service times, easier handling - contributing to increases in productivity and reduced operating cost. The LLS EVO emerges with its historic strengths well polished and integrated in a new generation optimisation.

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Complexities of media consumption power, water, Ar, N₂, O₂, H₂, vent nitrogen, and compressed air consumption are now displayed and recorded, available as current, monthly, and annual printouts conforming to ISO 14001

Equipment

Substrate size up to 200 mm square, max 200x200 mm, <15 mm thick
75mm@60
Batch capacity: Frontside loaded (round substrates): 75mm@48substrates, 100mm@36, 125mm@15, 150mm@12 substrates, 200mm@9.
Backside loaded (round@substrates)50x50mm@112.
75mm@36, 100mm@30, 125mm@12, 150mm@10, 200mm@8.
Deposition rate dynamic:
Au 200 Å /min (1 kW), WTi 180 Å /min (3kW): TaN 90 Å /min (1.5kW), Al > 700 Å /min (10kW): Cu >1000 Å /min (10kW), Ti > 300 Å /min (8kW): Ni 240 Å /min (3kW)
Magnet source AKQ515 with 127x 81mm target
Heater Process Main Chamber Degas LC - max 2 kW, power controlled
Process MC - max 4kW, power controlled, up to 350°C
Etching H₂ RF etch >18 Å/kWmin: Ion beam etch > 23 Å/kWmin
Vacuum Base press LC < 5x10 E-7mbar: Base press MC<1x10E-7mbar (CTI 8F onboard)
Substrate handling: manual or optional automatic cassette-to-cassette
Electrical data 3x400/230V AC, 50/60Hz, 30kVA: Water Cooling 18-25°C 60l/min
Compressed air 6-8 bar (87-116 psi): Process gas: Ar, N₂, O₂, H₂

Features

- High process flexibility, each of the five sources can be configured for either DC Sputtering: conductive materials, low doped reactive processes
RF Sputtering: dielectric materials and high doped reactive processes
RF/DC combined sputtering: increased rate for reactive sputtering
Pulsed DC sputtering: improved performance of low and high reactive processes also stress control for pure metals (eg Cr, NiV)
Co-sputtering: increased rates or individual alloy mixtures (up to 3 cathodes)
- Loadlock chamber for degassing; RF or ion beam etching assures clean surfaces and good adhesion • A unique valve separates the loadlock and main chamber to avoid particles and gaseous contamination, maintaining repeatable process conditions. • Movable shutter between sources eliminates cross-contamination, allows pre-sputtering (shutter closed) as well as co-sputtering. • Optimised rectangular cathode design for highest field homogeneity results in better magnetic fields.
- Easily convertible for different substrate sizes and shapes (small pieces up to standard 8" substrates, max. 200 x 230mm, frontside, backside loading). • Different substrate sizes in same batch are possible. • High vacuum pumping systems tailored to specific process requirements. • Fully automatic cassette-to-cassette(option) in two versions, unmasked or masked plus barcode reader • Windows XP-based control system displays status, trends, tracks and registers process information, manages alarms and recipe handling. • Segment sputtering possible • Passive cooling enables processes <100°C. • SEG5/GEM interface (optional) • Corresponds with ISO 14001